

Negative refraction and focusing of sound in phononic crystals

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Phononic crystals are periodic composite materials with lattice spacings comparable to the wavelength of sound (or ultrasound), and offer some advantages for studying the effects of periodic structure on wave propagation. In this talk I will summarize recent progress using ultrasonic experiments to investigate the focusing of ultrasound by negative refraction [1] in both two- and three-dimensional phononic crystals. In addition to reviewing the underlying mechanisms, experiments on three-dimensional crystals of tungsten carbide or steel beads in water will be described. Experiments that directly demonstrate the negative refraction of an ultrasonic beam in a two-dimensional crystal will also be presented. Our data are well explained using Multiple Scattering Theory, which predicts angles of refraction that are in remarkably good agreement with experiment.

- [1] Suxia Yang, J. H. Page, Zhengyou Liu, M. L. Cowan, C.T. Chan and Ping Sheng, *Physical Review Letters*, **93**, 024301:1-4 (2004).